OVAC Contract Report #2002-11

GEOPHYSICAL SURVEY AT THE DANBURY SITE (33OT16) IN DANBURY TOWNSHIP, OTTAWA COUNTY, OHIO

by

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Management Summary

On May 18, 2002, Ohio Valley Archaeological Consultants, Ltd. conducted a geophysical survey of a portion of the Danbury Site (33Ot16) on the Marblehead Peninsula in Danbury Township, Ottawa County, Ohio. The survey was conducted at the request of Mr. Greg Spatz of the United States Development Corporation. G. Michael Pratt originally recorded this site in 1977. According to the Ohio Archaeological Inventory form, several Archaic-type projectile points, a variety of ground-stone implements, lithic debris, human skeletal remains, a ceramic pipe-stem, and shell-tempered ceramics were recovered from this site. Pratt suggested that the Late Prehistoric period (post A.D. 1000) artifacts from the Danbury Site are related to another late period site (33Ot18), which is located approximately 50-100 meters to the east, outside the current study area.

In October of 1999, Ohio Valley Archaeological Consultants, Ltd., conducted a Phase I archaeological survey of a proposed 25 acre development encompassing the area around the Danbury Site. The Phase I investigation resulted in the recovery of fire-cracked rock, flint chipping debris, biface and core fragments, a slate artifact, one piece of shell-tempered pottery, and a variety of 20th century artifacts. The presence of fire-cracked rock indicates that the prehistoric inhabitants of this site constructed and used thermal facilities. Based on what is known about this site, especially the potential for prehistoric burials and features or other deposits below the topsoil, this site was determined to be potentially eligible for listing on the National Register of Historic Places.

Although the potential presence of subsurface features at the Danbury Site is indicated by the presence of fire-cracked rock, the Phase I survey did not verify this. The geophysical survey conducted on May 18, 2002 was designed to further evaluate the potential for subsurface deposits at the Danbury Site. A total of six 20x20 meter survey blocks (2400 m^2) was examined using a Geoscan Research FM36 Fluxgate Gradiometer. Magnetic data collected revealed what appear to be portions of a larger prehistoric village site with intact storage/garbage pits and semi-subterranean house basins. These data strongly resemble the Ensign Locality (33Sa93), a 15th century village just over 10 km southwest of the Danbury Site. Investigations at the Ensign Locality produced a heavy concentration of buried prehistoric features, such as garbage and storage pits, fire hearths, and semi-subterranean house basins (Bowen 2000).

Very few examples with such clear magnetic survey results exist in Ohio for a prehistoric village site. In order to better identify the magnetic anomalies, it is recommended that portions of at least one possible house and 2-3 possible pit features be subjected to controlled hand excavation. Once the below-ground nature of a sample of magnetic anomalies is confirmed, other magnetic anomalies can be identified with greater assurance. It is recommended that a total of 20 m^2 of hand excavation be conducted to further evaluate the magnetic anomalies observed at the Danbury Site.

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INTRODUCTION

On May 18, 2002, Ohio Valley Archaeological Consultants, Ltd. conducted a geophysical survey of a portion of the Danbury Site (33Ot16) on the Marblehead Peninsula in Danbury Township, Ottawa County, Ohio (Figures 1-3). The geophysical survey was conducted at the request of Mr. Greg Spatz from United States Development Corporation. At total of six 20x20 meter blocks (2400 m^2) was investigated using the Geoscan Research FM36 Fluxgate Gradiometer.

Purpose of Investigation

The purpose of the geophysical survey was to further evaluate the archaeological potential of the Danbury site. Although the Phase I investigation resulted in the recovery of evidence supporting the presence of buried archaeological deposits at this site, actual buried archaeological features were not encountered. The geophysical survey was designed to identify near surface magnetic anomalies characteristic of potential, buried archaeological phenomena. This type of survey is useful on several levels. First, it allows for the investigation of a relatively large amount of surface area with no physical disturbance of the archaeological site. Investigating a similar amount of area using traditional excavation techniques would be far more time consuming, costly, and physically destructive of the archaeological record. Second, geophysical data from a large spatial area allow archaeologists to visually identify patterning of potential archaeological anomalies. This is difficult to accomplish with the use of traditional methods, which would involve the hand excavation and mechanical removal of sediment from a very large area. Third, geophysical survey data provide a better evaluation of a given site in terms of the potential for subsurface features than a traditional Phase II assessment, which would not normally involve the investigation of an equivalent amount of space and could altogether miss buried archaeological phenomena.

It is our opinion that geophysical survey should be used as an important tool for archaeological site assessment prior to the implementation of traditional excavation approaches. Geophysical data provide a means for pinpointing potential subsurface archaeological phenomena and are useful for planning and executing excavations. While geophysical data can be used independently to address research questions about topics ranging from settlement size and layout to estimating human population density at a given site, artifacts derived from controlled surface collections and excavations are still needed. Surface and/or excavation data coupled with geophysical survey results represent a powerful suite of information for learning about the past while at the same time preserving this fragile resource.

Project Background and Description of the Danbury Site (33Ot16)

The following site description was adapted from the Phase I archaeological survey report conducted by Ohio Valley Archaeological Consultants, Ltd. (Pecora 1999). The Danbury Site is located on the Marblehead Peninsula in Ottawa County, Ohio (Figures 1-3). The site is situated on a prominent rise overlooking the Sandusky Bay to the south. According to the previous landowner (Mr. R. Bauman), the adjacent area to the north of the site consisted of marshland until the turn of the century, when it was drained for agricultural use. Prior to grain crop agriculture and recreational land-use, the site area was used in a variety of ways. According to the previous landowner (Mr. Bauman), vineyards were planted in the 1860s. By the turn of the century, peach and apple orchards had replaced the grapevines. After the 1950s, grain crops were reintroduced. Farm outbuildings were situated in the southeastern portion of the site between the1860s and 1900. According to Mr. Bauman, part of this area was used as a pig-lot after 1900. No evidence for the original farmstead structures is currently present.

In 1977 G. Michael Pratt, then of the OHPO, University of Toledo, originally recorded the Danbury Site as an Archaic site with a minor Upper Mississippian component. No known archaeological report was generated from this early work at the site. According to the Ohio Archaeological Inventory (OAI) form, a local collector (Pat Steiner) recovered a wide range of objects from the site, including side-notched, corner notched, and stemmed projectile points; a drill fragment; celt fragments made of granite and slate; large quantities of lithic debris; and human skeletal remains. In addition, a ceramic pipe-stem and a few shell tempered pottery sherds were also found. The OAI site form also states that these Late Prehistoric period (Upper Mississippian) artifacts are thought to be associated with site 33Ot18, located approximately 50-100 meters to the east. Site 33Ot18 is represented by a collection of grit and shelled tempered pottery, a Madison-like projectile point, celt fragments, and stone tool making debris, based on information provided on the site's OAI as completed by Pratt in 1977.

The more recent Phase I investigation (Pecora 1999) identified a large (28,800 m^2) scatter of prehistoric artifacts, all of which were recovered from the plowzone and surface soil layer (Figure 3). At the time of the original Phase I survey, slightly over one-half of the site was situated within a standing cornfield. Surface visibility in this area was good to excellent (50-100%), providing an opportunity to conduct a controlled surface collection (Figure 3). A trailer/camper campground was situated over the southeastern one-half of the site, which was vegetated with mowed grasses and trees. Shovel tests were excavated in this area. Since the Phase I survey, all of the trailers and campers have been removed. The vegetation in this area currently consists of high grasses and scrub growth.

Shovel tests (n=31) excavated within the site area revealed a dark grayish brown (10YR4/2) silt loam or sandy silt loam topsoil (12-32 cm thick), over a light yellowish brown (10YR6/4) gravelly, silty clay subsoil (Pecora 1999). The sandy silt loam is concentrated in the higher areas of the site's central portion. No archaeological deposits or features were observed below the surface soil layer during this initial survey.

The Phase I investigation resulted in the recovery of a wide range of prehistoric (n=318) and historic artifacts (n=34) from shovel tests and surface collection cells (Figure 3) (Pecora 1999). Positive shovel tests and surface collection cells cover approximately 28,800 m^2 within the project area boundaries. It is likely that the site extends to the east, beyond the project boundaries. Prehistoric artifacts include lithic debris (n=240), biface fragments (n=3), a unifacially modified flake (n=1), small flake cores and flake core fragments (n=11), one chipped slate perform (n=1), fire-cracked rock (FCR) (n=28), and one shell tempered pottery sherd (n=1). Several small mammal and fish bones (n=27) and shell fragments (n=6) were also recovered. The FCR suggests that thermal features, such as prehistoric hearths and other cooking facilities, may be present at this site. The pottery sherd indicates a Late Prehistoric component (ca. A.D. 1500) (Bowen 1994), as was reported by Pratt. No Archaic artifacts or human remains were encountered during the Phase I investigation (Pecora 1999).

Historic artifacts (n=34) recovered include ceramics (n=5), container glass (n=19), flat glass (n=1) plaster (n=2), nails (n=6), and a sawed ham steak or round steak bone (n=2) (Table 4). These artifacts appear to have a 20th century origin and may have been deposited as a result of historic-era and modern activities within the site area.

Based on the results of the Phase I survey, it is likely that at least part of the archaeological deposit at the Danbury site represent a 16th century settlement. A number of settlements from this time period have been studied in the Sandusky Bay area (Bowen 1994). One archaeological investigation at the Ensign Locality (33Sa93), a 15th century village just over 10 km southwest of the project area, produced a heavy concentration of buried prehistoric features, such as garbage and storage pits, fire hearths, and semi-subterranean house basins (Bowen 2000). Figure 4 shows the layout of the archaeological features encountered during Bowen's investigation. Numerous keyhole shaped house basins are depicted with nearby storage pits and fire hearths. Keyhole shaped houses are a fairly rare house type in Ohio and to date have been found almost entirely in northern parts of the state. Other projects at villages from this era have found that these settlements tend to cover about one hectare (100x100 meters) and are surrounded by a shallow ditch five to seven meters across (Abel 1999; Abel *et al.* 2000).

SOILS AND GEOLOGY

The project area tested during the geophysical survey is located on St. Clair silty clay loam soils (USDA-SCS 1985). These soils have developed in compact glacial tills. Two observations regarding the soils in the project area are worthy of note. First, silty clay soils are an optimum setting for using magnetic remote sensing devices to locate buried archaeological features. Clay rich sediments tend to have a high magnetic contrast with organic rich topsoils. Very commonly, prehistoric pits and other nearby depressions were filled with or became filled with organic rich trash in antiquity. The depth of such trash filled pits in silty clay soils produces a strong (5-12 nT), well-defined magnetic

signature because of the contrast between the organic rich, trashed filled pits and the surrounding clay rich subsoils.

The second soil related observation was made in the field during the magnetic survey. The survey blocks are dotted with cobble to small boulder-sized stones (single to double fist sized), some of which produced a notable, positive magnetic spike during the survey. Such magnetic anomalies are easy to mistake for prehistoric features when interpreting the magnetic data. However, these stones typically produce a much tighter, more symmetrical positive anomaly with a slightly higher peak (10-20 nT) than typical prehistoric features, such as postholes from a building foundation. Furthermore, stones tend to be arrayed randomly about the field while postholes occur in groups. Therefore, care is taken in discussions and interpretations of the data so as not to misidentify stones as small prehistoric pits or large postholes.

INSTRUMENTATION AND SURVEY DESIGN

The geophysical survey was conducted using a Geoscan Research FM36 Fluxgate Gradiometer. The Fluxgate Gradiometer was specially made for archaeological applications and is ideal for detecting subtle variations in the earth's magnetic field caused by near-surface phenomena. This instrument contains two fluxgate detectors in a gradiometer array—that is, the two detectors are arranged one atop the other with a 50 cm separation. The upper most detector senses the earth's background magnetic field, which in the Midwest U.S. measures approximately 50,000-60,000 nanoTesla and can vary as much as a hundred or a thousand nanoTesla from morning to evening in one day. The lower detector senses the earth's background magnetic field *and* changes in it caused by objects or soils on the surface or up to about two and a half feet beneath the surface. Fired earth in prehistoric hearths and organic rich soil in buried trash pits tend to concentrate the earth's magnetic field in measurable amounts of approximately 3-15 nanoTesla. The instrument's onboard computer subtracts the reading of the top detector (earth's varying background magnetism) from the reading of the bottom detector (earth's varying background magnetism and local magnetic variability), leaving the local magnetic variability caused by surface and buried phenomena. This number is stored in the instrument until a data dump is performed, about 2-3 times a day.

Geophysical surveys are typically conducted by taking numerous readings along parallel lines (a.k.a. transects) in a rectilinear block (a.k.a. block). The survey described in this report recorded near-surface magnetic variability in six 20x20 meter blocks in two areas (Figure 5). Area 1 contains four 20x20 meter blocks and was situated on a slight topographic high in an area where prehistoric objects were found during the Phase I testing. Area 2 is made up of two 20x20 meter blocks, and is also located on a slight rise, and is also in an area that produced prehistoric artifacts during the Phase I survey. A laser transit was used to layout all block corners and two semi-permanent site datums along the road at the west side of the project area. The datums will allow for the near perfect re-establishment of the geophysical survey blocks for future survey or precision excavation of

magnetic anomalies. Data collection transects were spaced 50 cm apart and 8 magnetic readings were logged per meter, producing 6,400 readings per block.

Once the data were dumped from the Fluxgate Gradiometer to a laptop computer, Geoscan Research's Geoplot software was used to process the data. Such processing is fairly common and involves applying complex mathematical algorithms to the data in an effort to reduce background noise and accentuate the potential, buried archaeological phenomena.

EXPECTED RESULTS

Based on the information presented in the background section concerning previous projects on potentially similar sites in similar landscape settings, we can develop a set of expected results for the present geophysical survey. Table 1 lists the relative probability of detection of a variety of known historic and prehistoric anomalies using the Geoscan Research FM36 Fluxgate Gradiometer. Keyhole shaped house basins should produce positive magnetic highs about 2-4 meters across that match the shapes of known house basins. While the map of the Ensign Locality does not show any pits or fire hearths inside its houses, it is possible that the house basin magnetic signatures encountered at the Danbury site will contain other magnetic signatures inside them. Since these villages tend to have a high density of pits and houses, it is possible that the magnetic data may contain a large number of 50 cm to 2 meter diameter magnetic anomalies in the 2-8 nanoTesla range. Postholes will be difficult to detect because of their small size and the 50 cm transect interval used in the survey.

Because of the proximity of a recently abandoned trailer park/campground in the southeastern part of the project area, historic metal objects may be encountered in higher than expected numbers. Metal objects tend to produce a strong positive and strong negative signature directly adjacent to one another (a 'dipole') and are therefore easy to identify. Because iron based metals are highly magnetic, iron objects tend to produce very strong signatures (50+nanoTesla). Unless historic trash dumping areas are present in the existing agricultural field, the number of metal objects should decrease with distance from the trailer/campground area.

Table 1. List showing the probability of detection for known target anomalies using the Geoscan Research FM36 Fluxgate Gradiometer.

Historic	**Prehistoric**	**Other**	**FM 36 Probability of Detection**
Gravel Paths			Low
Brick Foundation			High
Scattered Brick			High
Ferrous Metals (nails)			High
Limestone (negative)			No-Low
Historic Posts			Medium
Wells			High
Cisterns			High
Privies			High
Historic Grave Shaft			Medium
	Basin/Pit House		Medium-High
	Prehistoric Pit		Medium-High
	Prehistoric Burial		Medium-High
	Prehistoric Hearth		High
	Prehistoric Posts		Low-Medium
	Prehistoric Midden		Low-Medium
		Tree Root Casts	Low-Medium
		Plow Scars	Medium-High
		Rodent Burrows	No-Low-Medium
		Burned Trees	High
		Tractor Parts	High
		Stones	No-High

GEOPHYSICAL SURVEY RESULTS

Figure 6 shows the results of the magnetic survey plotted on the site map, which highlights the spatial relation of the data from Areas 1 and 2. Even at this coarse scale, numerous, positive monopoles are evident in both areas. Also apparent, especially in Area 1, are parallel linear lines of negative readings. These most likely represent areas where the plow has dug slightly deeper into the underlying clayey subsoil. No obvious ditch features circumscribing the site area are present in the magnetic data. This suggests that no ditch feature is present at the Danbury site, or, more likely, the magnetic survey did not cover enough ground to encounter the edge of the 16th century occupation.

Figure 7 shows a closeup view of the magnetic data from Area 1. The white arrows indicate just a few of the dipole signatures of small to medium sized iron objects. Many of the larger positive anomalies (dark areas) likely represent house basins and pit features. In Figure 8 the high probability prehistoric features have been outlined and the magnetic data has been deleted. Probable house basins are gray and numbered. It must be stressed that such a plan map of the probable prehistoric features is an interpretation and, without at least some excavation to ground truth a sample of the anomalies, cannot be relied upon solely. Nevertheless, it is clear that some of the larger anomalies, especially numbers 9 and 10, look remarkably like the keyhole shaped house basins from the Ensign Locality. While it is impossible to know the exact function of each probably cultural feature, the density of potential features at the Danbury site is consistent with the village remains from other late village sites in the Sandusky Bay area. All human burials at the Ensign Locality were extended inhumations with the head to the east and the feet to the west. A number of oval magnetic anomalies with dimensions similar to those expected for a human extended burial are evident in the Danbury magnetic data. In fact, a cluster of such anomalies is present between potential house basins 5 and 6.

In Figure 9 a closeup of Area 2 is shown. While this area does not have near as many large, positive monopoles, a few are present. Also, no obvious keyhole shaped anomalies are evident. However, one area in the middle of the data blocks does potentially represent the remains of a house structure (perhaps not in a basin) and is outlined by a dotted line in Figure 8. Again, Figure 8 shows the highest probability anomalies that may represent prehistoric pit features and structural remains.

SUMMARY AND RECOMMENDATIONS

Clearly the areas tested using the Fluxgate Gradiometer revealed portions of a large prehistoric settlement, perhaps a village site, with intact storage/garbage pits and semi-subterranean house basins. Very few examples of such clear magnetic survey results for a prehistoric village site exist in Ohio. In order to better identify the magnetic anomalies, it is recommended that portions of at least one possible house and 2-3 possible pit features be subjected to controlled hand excavation. Once the below-ground nature of a sample of magnetic anomalies is confirmed, other magnetic anomalies can be identified

with greater assurance. Such an excavation would provide a foundation for developing a more precise site/settlement plan map for the areas surveyed.

It is our recommendation that no more than 20 m^2 of area need be hand excavated over selected magnetic anomalies at this phase of the investigation. Individual $1m^2$ units should be excavated. The plowzone fill from each excavation unit should be screened using a ¼" mesh and all artifacts should be collected accordingly. When necessary, contiguous $1m^2$ units should be excavated over larger anomalies, such as potential houses, in order to uncover at least half of the anomaly in planview. Each anomaly should be documented using standard archaeological procedures. Photographs and illustrations are necessary for planviews and profiles. It is recommended that at least half of each anomaly be excavated to expose the profile shape. If feasible, opposing quarters of each feature should be excavated. It is recommended that the features should be excavated at arbitrary 10 cm levels. If stratigraphy is observed within the feature profile, then each stratum should be excavated separately. At least 30 liters of sediment from each feature should be collected for flotation processing, which is necessary for recovering small burned plant and animal remains indicative of prehistoric food consumption patterns. Selected carbon samples should be submitted for radiocarbon dating. All artifacts, botanical materials, and faunal remains should be analyzed using published standards and techniques. In the event that human remains are encountered, the excavation should be terminated and United States Construction Company should be contacted immediately.

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1985 *Soil Survey of Ottawa County Ohio.* United States Department of Agriculture, Soil Conservation Service in cooperation with ODNR, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

Figures

Figure 1. State of Ohio map showing general location of the project area.

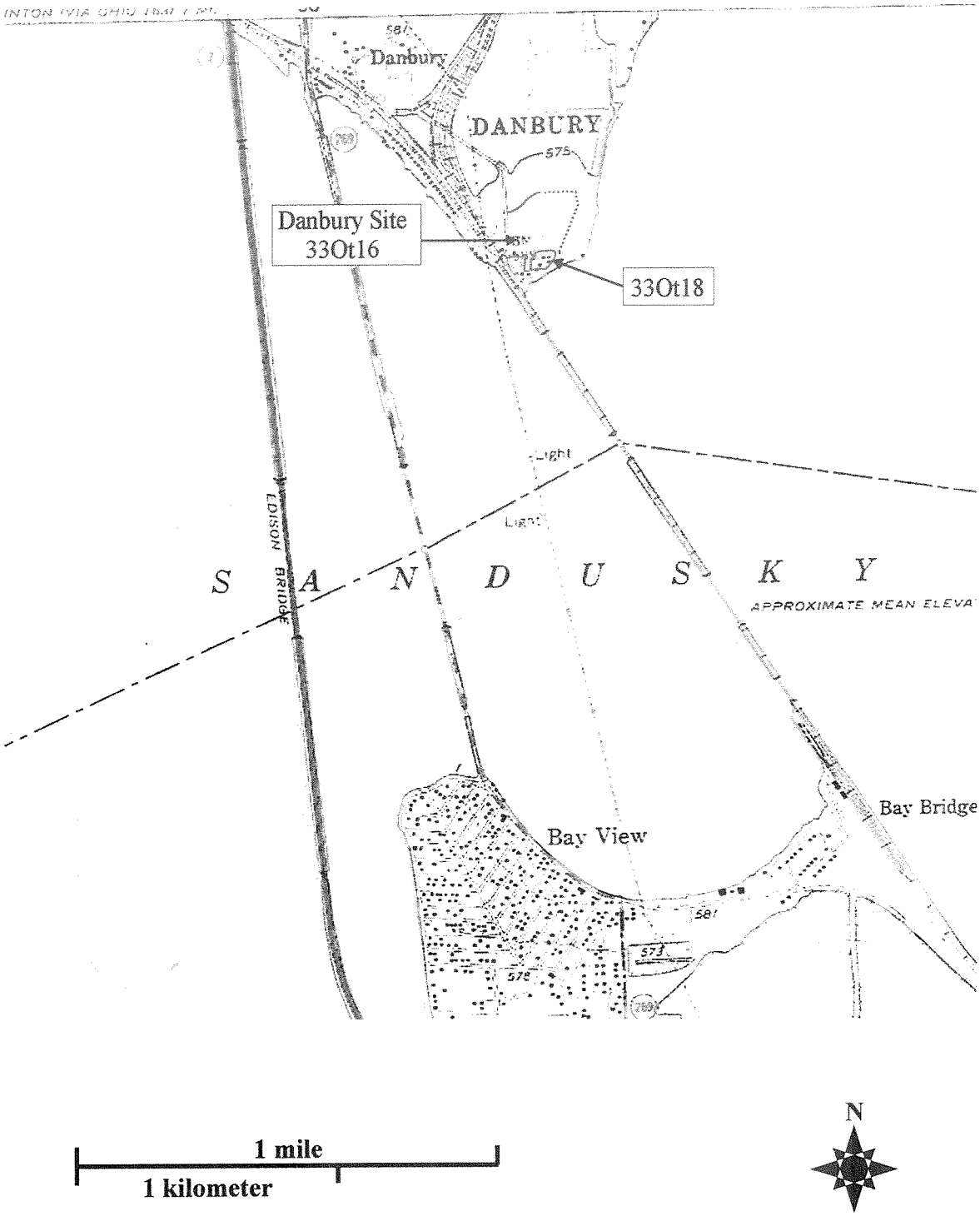


Figure 2. Portion of the 1969 Castalia, Ohio, 7.5' USGS topographic map showing the location of the Danbury Site (33Ot16) and site 33Ot18.

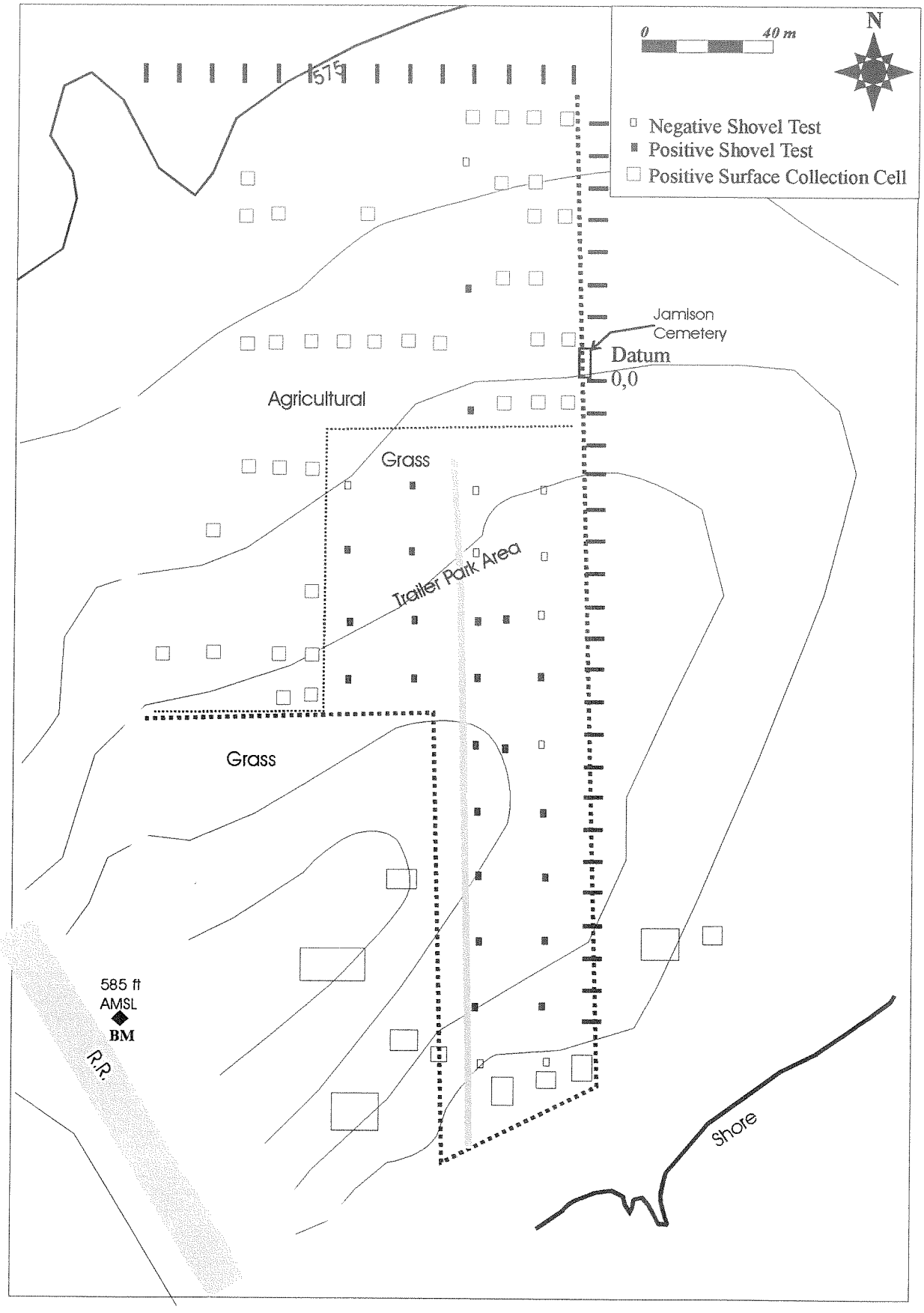


Figure 3. Schematic illustration of the Danbury Sute (33Ot16) showing Phase I archaeolocial survey results (Pecora 1999).

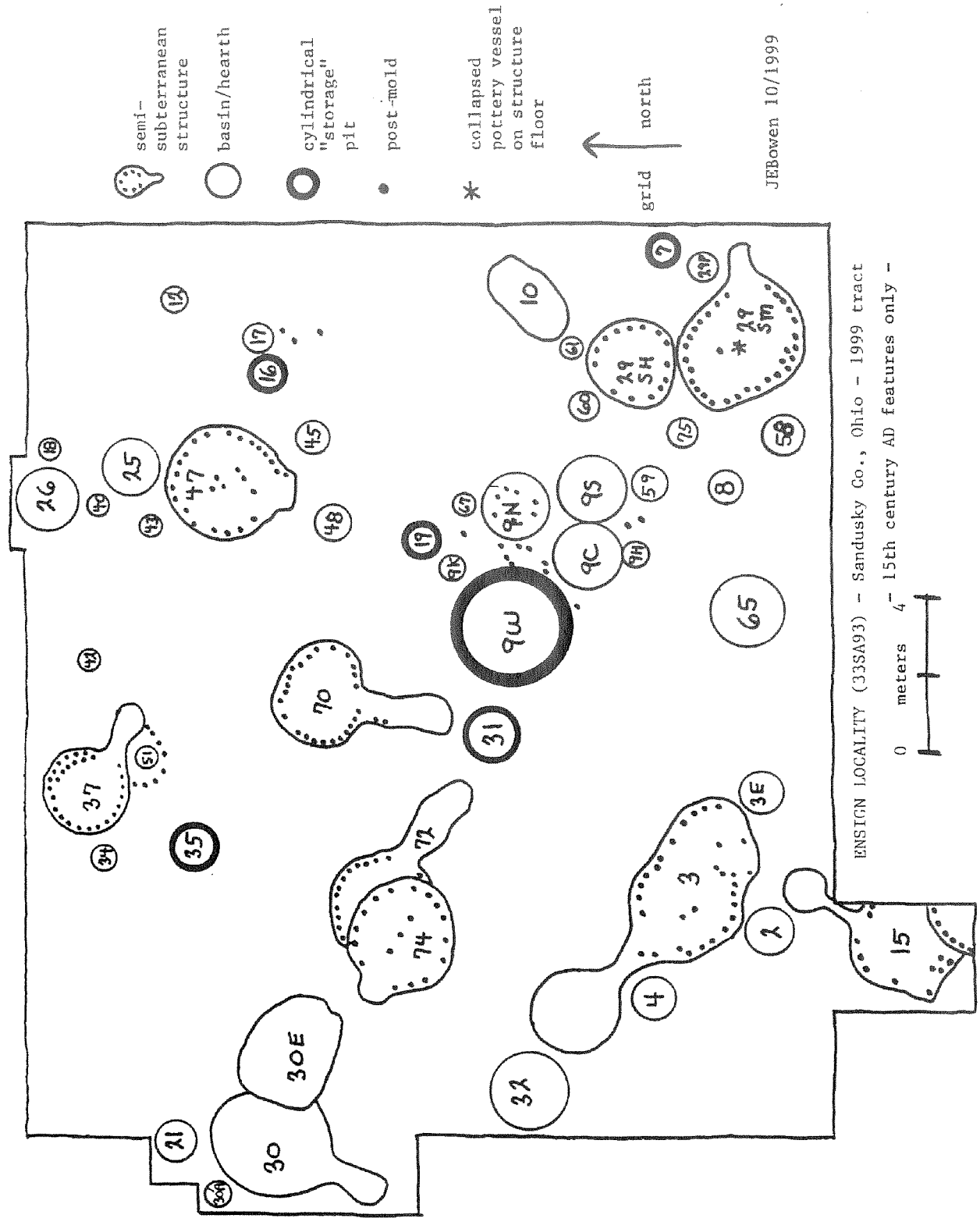


Figure 4. Ensign Locality (33Sa93) site plan of area excavated in 1999 (from Bowen 2000).

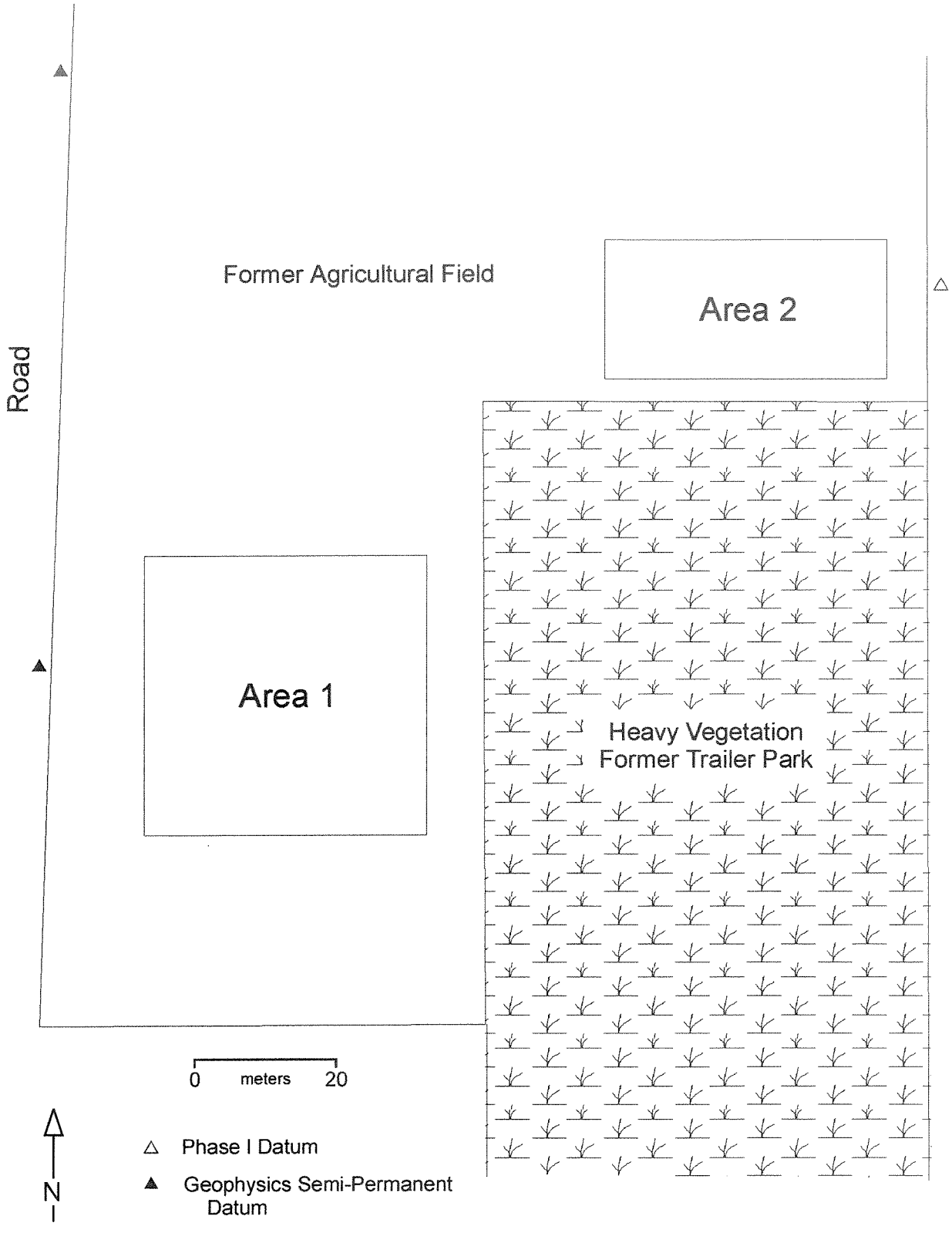


Figure 5. Map of the project area showing the location of the geophyiscal survey blocks.

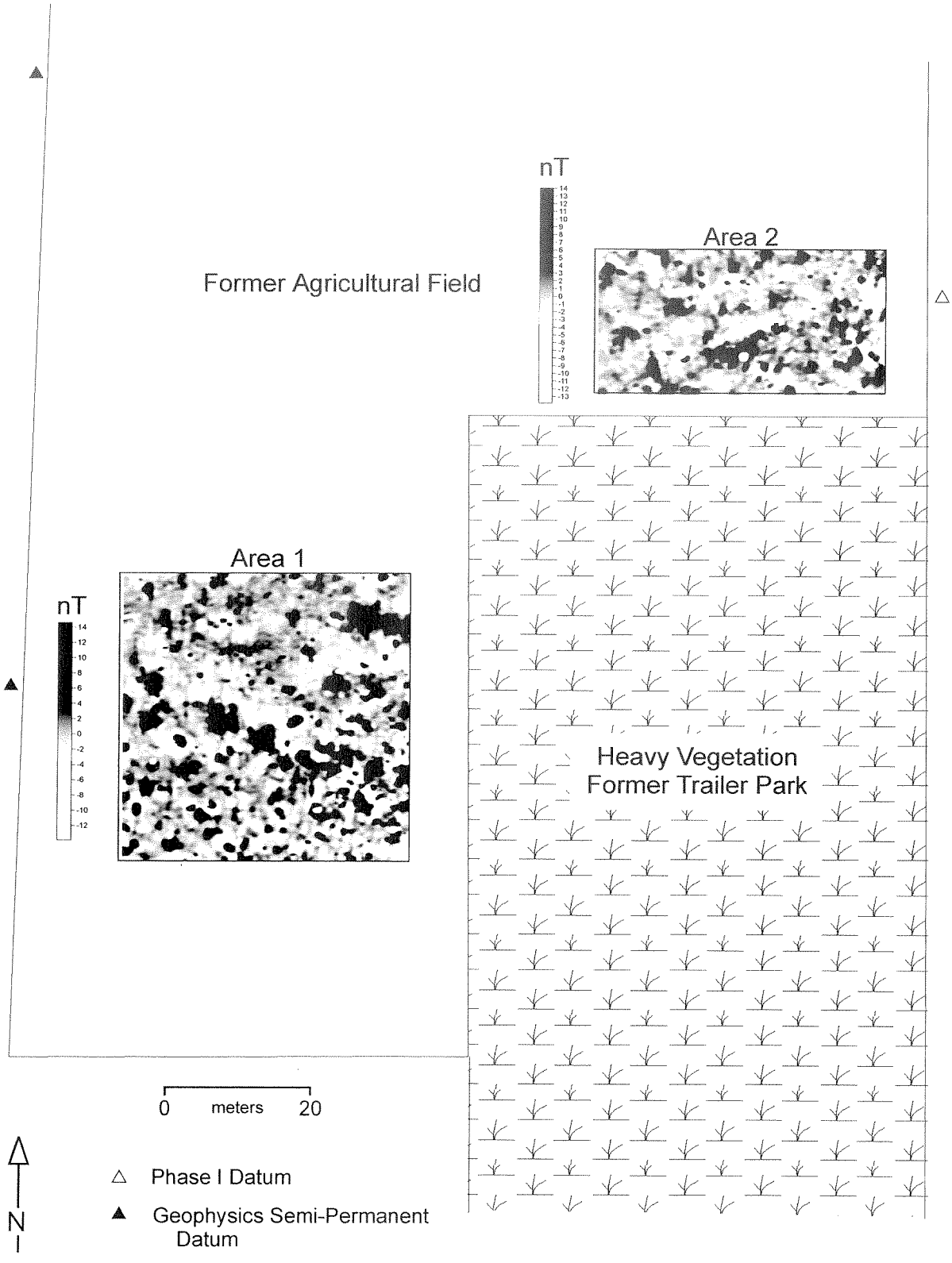
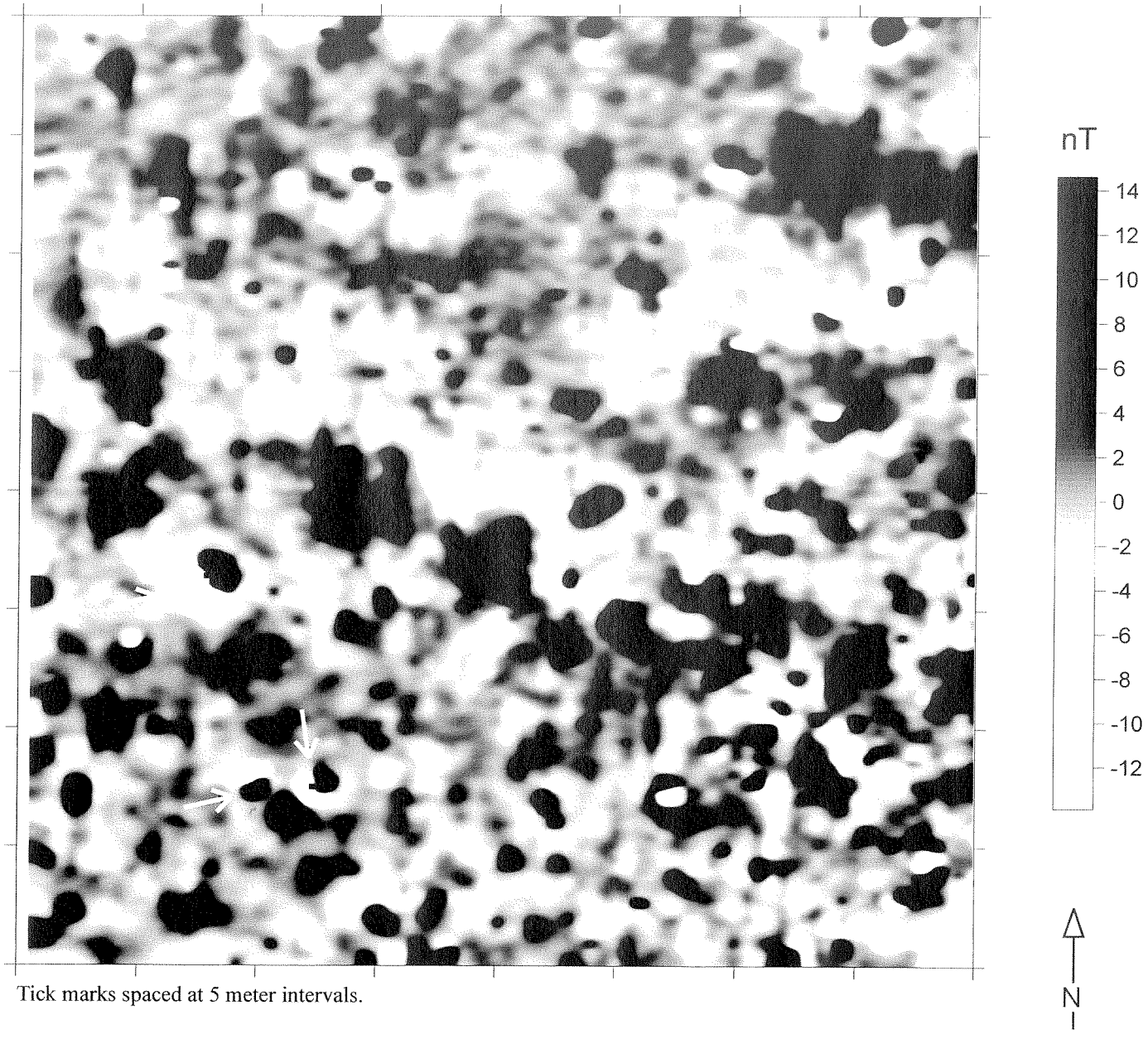


Figure 6. Map of the project area showing the processed magnetic data.



Tick marks spaced at 5 meter intervals.

Figure 7. Area 1 magnetic data enlargement.

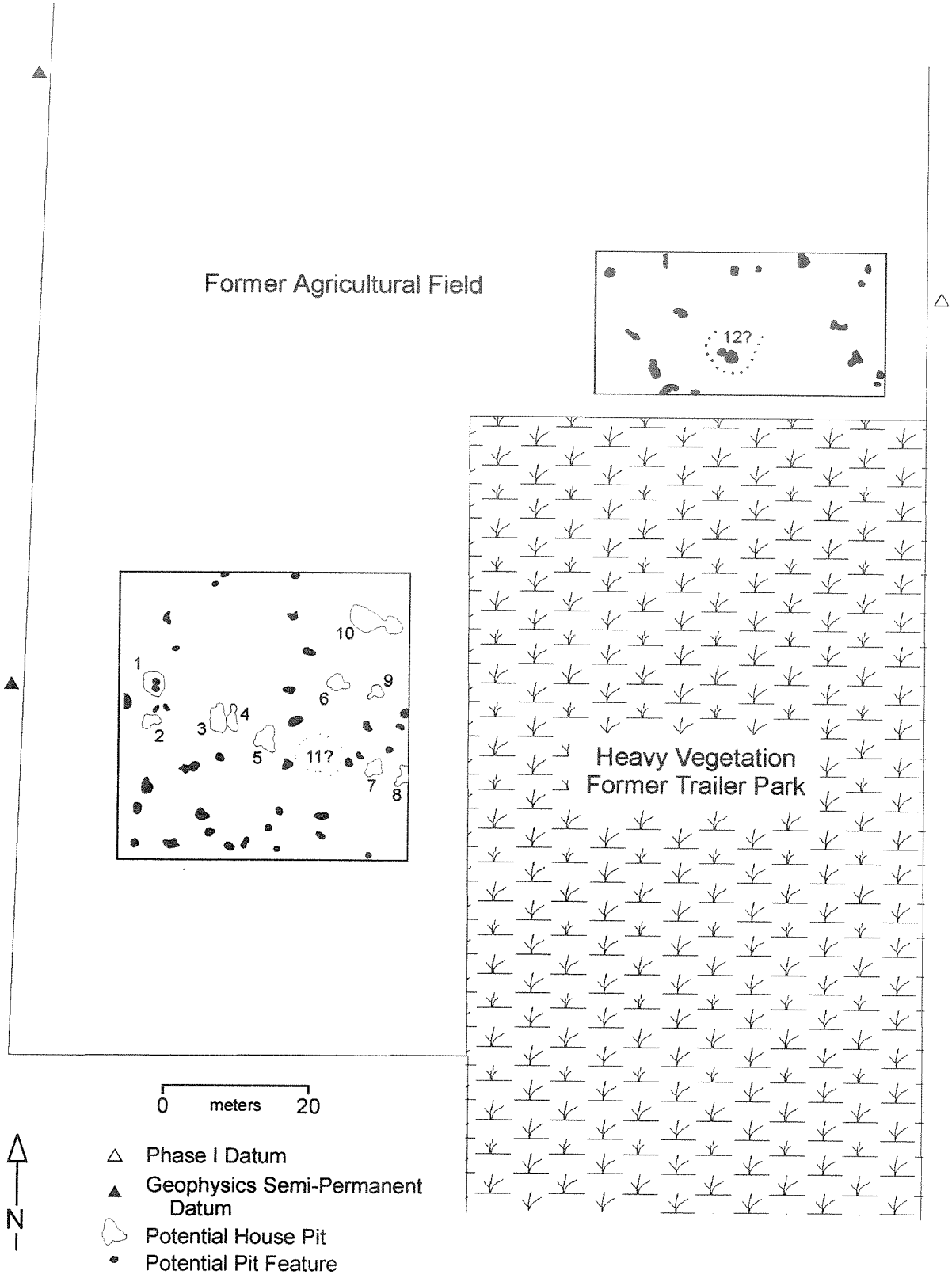
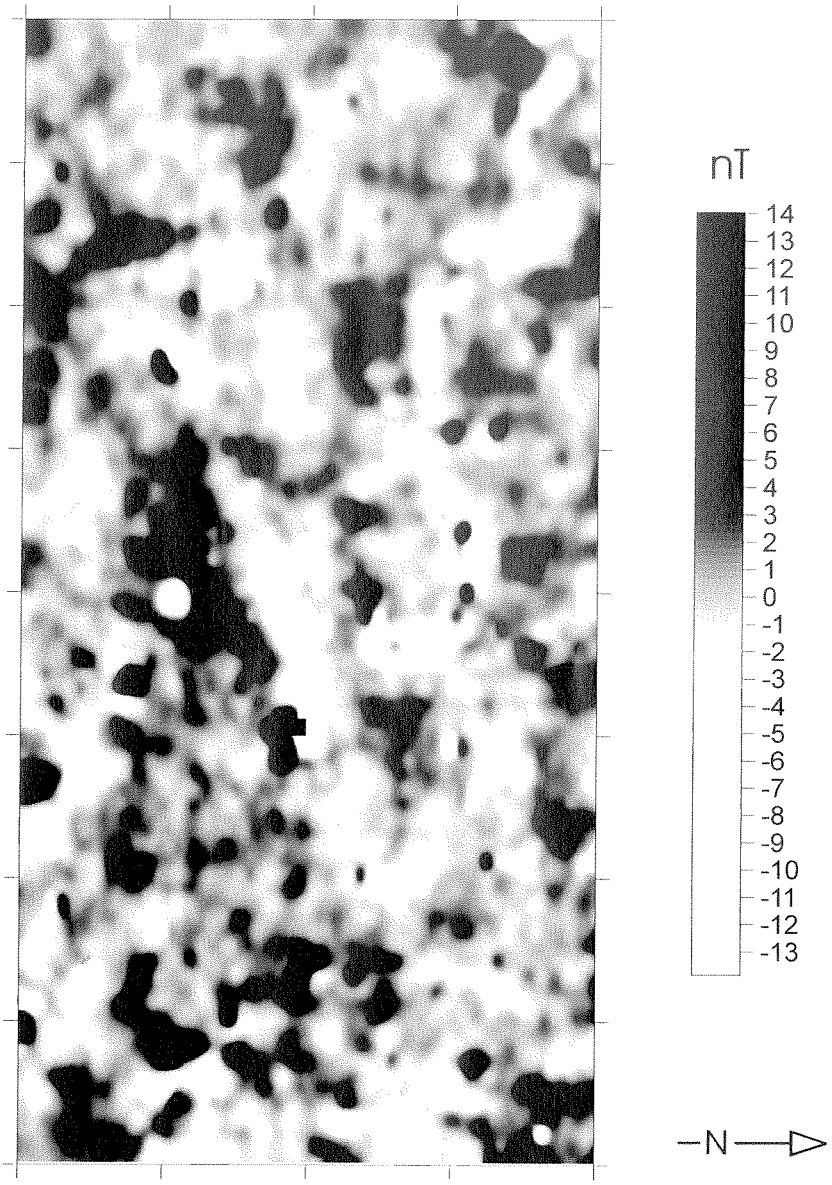


Figure 8. Map of the project area showing the proposed location of prehistoric features.



Tick marks spaced at 5 meter intervals.

Figure 9. Area 2 magnetic data enlargement.